

DEVELOPMENT OF AUTOMATIC FISH GRADING MACHINE ESPECIALLY FOR
CATFISH WITH LOW TIME CONSUMPTION AND LOW CAPACITY USAGE

WAN MUHAMMAD MUHLIS BIN WAN SALLEHUDDIN

A report submitted in partial fulfillment of the requirements
for the award of the degree of
Bachelor of Mechanical Engineering with Manufacturing Engineering

Faculty of Mechanical Engineering
UNIVERSITI MALAYSIA PAHANG

JUNE 2008

SUPERVISOR'S DECLARATION

We hereby declare that we have checked this project and in our opinion this project is satisfactory in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering with Manufacturing.

Signature : _____

Name of Supervisor : EN FADHLUR RAHMAN BIN MOHD ROMLAY

Date :

Signature : _____

Name of Panel : EN MOHD FADZIL FAISAE AB RASHID

Date :

STUDENT'S DECLARATION

I hereby declare that this project report entitled “Development of Automatic Fish Grading Machine Especially for Catfish with Low Time Consumption and Low Capacity Usage” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

Signature : _____
Name : WAN MUHAMMAD MUKHLIS BIN WAN SALLEHUDDIN
ID Number : ME05026
Date :

Special dedicated to my beloved Father, Wan Sallehuddin Wan Zakiuddin, Mother, Ku
Meriam Ku Hamzah, my brothers
&
my supervisor, Fadhlur Rahman B. Mohd Romlay
for their support and care.

ACKNOWLEDGEMENTS

I would like to express my special gratitude to Faculty of Mechanical Engineering; University Malaysia Pahang for providing all the information online as the guidelines towards the completion of this report.

My utmost appreciation goes out to my supervisor En Fadhlur Rahman B. Mohd Romlay for his guidance and enormous amount of time spent in assisting me in this study. Without his advice and assistance, the study would have been a lot tougher for completion. I also would like to express very special thanks to all of Mechanical Technical Assistance Staff for providing me some useful knowledge to use the software and machines during fabrication process.

My sincere thanks go to En. Mohd Rizal B. Mat Ali, En. Muhamad Rozikin B. Kamaluddin and En. Hazami B. Che Hussain lab instructor of the Mechanical Engineering Department, UMP, who guided me during welding process, punching process and lend me lab equipments.

I acknowledge my sincere indebtedness and gratitude to my parents for their love, dream and sacrifice throughout my life. I cannot find the appropriate words that could properly describe my appreciation for their devotion, support and faith in my ability to attain my goals. Special thanks should be given to all of my friends for their comments and suggestions, which was crucial for the successful completion of this study.

ABSTRACT

Development of fish grading machine is a new automatic system especially for catfish for low time consumption and low capacity usage. The system is worked according to the measured sizes that want to be grade. In aquaculture sector, grading machine is very important to grade the size in order to avoid the small fishers are eaten by the big fish especially carnivore type such as catfish. This automatic machine consists of some mechanism as the main function on how the machine will be operated. This machine is created consists of linkages, DC power supply, chain and gearing system in order to operate the machine. ALGOR analysis is used to analyze and determine the critical part of the machine structure in order to know the toughness and the tensile strength of the material to be used. The tensile strength of the structure complete with 150 N loads is validated with theory and the agreement between them is achieved. The maximum value of the material steel AISI 1010 from the analysis is $26.4543 \text{ N/(m}^2\text{)}$ which is lower than yield point of the material.

ABSTRAK

Membangunkan sebuah mesin pengelasan saiz menggunakan sistem automatik khusus untuk ikan keli dengan kadar masa yang pendek adalah satu pembaharuan untuk pengelasan saiz ikan keli hidup. Sistem ini berfungsi dengan kadar saiz ikan yang ditetapkan untuk pengelasan. Dalam sektor akuakultur, mesin pengelasan ikan adalah penting untuk mengelas ikan mengikut saiz supaya ikan-ikan kecil tidak dimakan oleh ikan-ikan besar terutama ikan pemangsa seperti ikan keli. Mesin pengelasan ikan ini terdiri daripada sambungan rod besi kepada kawal pembukaan, pembekal arus terus, rantai dan juga sistem gear dalam menggerakkan mesin ini. Perisian ALGOR digunakan dalam menganalisis struktur asa mesin untuk mengetahui dimana berlakunya tempat kritikal mesin jika muatan berlebih dikenakan dan juga untuk menganalisis kekuatan dan ketegangan struktur asas mesin dari bahan yang digunakan. Ketegangan struktur yang dibebani oleh daya 150 N adalah cukup untuk ditampung dan ianya di buktikan dengan perbandingan data dan teori yang lengkap. Nilai maksimum yang diperolehi daripada analisis ialah $26.4543 \text{ N/(m}^2\text{)}$ dimana ianya lebih rendah berbanding titik ketegangan bahan itu sendiri.

TABLE OF CONTENTS

	Page
SUPERVISOR’S DECLARATION	ii
STUDENT’S DECLARATION	iii
DEDICATION	iv
ACKNOWLEDGEMENTS	v
ABSTRACT	vi
ABSTRAK	vii
TABLE OF CONTENTS	viii
LIST OF TABLES	xii
LIST OF FIGURES	xiii
LIST OF SYMBOLS	xv

CHAPTER 1 INTRODUCTION

1.1	Introduction	1
1.1.1	Agricultural	2
1.1.2	Important of Agriculture	7
1.1.3	Aquaculture Sector	8
1.1.4	Fresh Water Fish	9
1.1.5	Catfish Farming	10
1.2	Problems in Aquaculture	12
1.3	Objective of the project	13
1.4	Scope of project	13

CHAPTER 2 LITERATURE REVIEW

2.1	Introduction	15
2.2	Fish Grading	15
2.2.1	Machine Grading	16
2.2.1.1	STAVA belt grader	16
2.2.1.2	PR Aqua belt grader	18
2.2.1.3	The Supported Pump	19
2.2.2	Box Graders With Insert	20
2.2.2.1	Box grader with insert	20
2.2.2.2	Adjustable one piece grader	22
2.2.3	Hand Grading	23
2.3	Summary of literature	25

CHAPTER 3 METHODOLOGY

3.1	Introduction	26
3.2	Designing	26
3.3	Fabricating	27
3.3.1	Milling and Drilling Machine	27
3.3.2	Grinding Machine	28

3.4	Mechanism	28
3.4.1	Linkage	28
3.4.2	Motor	29
3.4.3	Gearing System	29
3.5	Material selection	29
3.6	Design Sketch	30
3.6.1	First Design	30
3.6.2	Second Design	31
3.6.3	Third Design	31
3.6.4	Comparison Between Design	32
3.7	Flowchart of the Project	33

CHAPTER 4 RESULTS AND DISCUSSION

4.1	Introduction	34
4.2	Mechanism Design Analysis	34
4.2.1	Main Body Structure	35
4.2.2	Mechanical and Mechanism Function	36
4.2.2.1	Gearing System and Function	36
4.2.2.2	Bolt and Nut Application	37
4.2.2.3	Blocker and Slider	39
4.2.2.4	Step in Assembly Automatic Fish Grading Machine	40
4.2.3	Comparison between Actual Design and the CAD Design	42
4.3	Fabrication Analysis	43
4.4	Main Body Structure Analysis	46
4.5	Efficiency and Time Analysis	51

CHAPTER 5 CONCLUSION AND RECOMMENDATIONS

5.1	Conclusions	55
5.2	Recommendations	56

REFERENCES	57
-------------------	----

APPENDICES

A	Actual product of The Automatic Fish Grading	59
B	Machine(side view)	60
	Actual product of The Automatic Fish Grading	
	Machine(back view)	
C	Table of project activity	61
D	Final year project Gantt chart	64

LIST OF TABLES

Table No.		Page
4.1	Setup schedule general data of operation	43
4.2	Clamp position	45
4.3	Tool path	45
4.4	Parameters that will consider during analysis	47
4.5	Properties table of Steel (AISI – 1010)	50
4.6	Data of grading and efficiency	51

LIST OF FIGURES

Figure No.	Title	Page
2.1	STAVA beltgraders	17
2.2	PR AQUA beltgraders	18
2.3	The Supported Pump	19
2.4	Box grader with the insert(front view)	21
2.5	Box grader(top view)	21
2.6	Adjustable one piece grader	22
2.7	Hand grading method	26
3.1	Milling and drilling machine	24
3.2	Linkage connect	28
3.3	Grading machine design(first design)	30
3.4	Second design	31
3.5	Third design	31
3.6	Flowchart of the project	33
4.1	Main body structure of the machine	35
4.2	Gearing system at motor	36
4.3	Gearing system at roller	37
4.4	Bolt and nut application	38
4.5	Third nut application	38

4.6	Blocker and slider	39
4.7	Full assemble of automatic fish grading machine	41
4.8	Extra control holder attachment	42
4.9	Force applied in ALGOR analysis	46
4.10	Analysis result	48
4.11	Bending structural	49
4.12	Yield strength graph	49
4.13	Set system	53

LIST OF SYMBOLS

mm	millimetre
cm	centimetre
DC	direct current
CAD	Computer Aided Design
s	second
%	percentage
X	vertical axis
Y	horizontal axis
/	divide
kg	kilogram

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The era of machine start in early 1800's when the revolution of industry happened. During this time, machine is developed to help the farmer with machine to help in their process. Beside that, the technology has been developed drastically during world war to help the troops and army to improve their weapons technology. But after the World War II ends, the using of technology is develop drastically not just to improve weapons but then it is develop to industrial sector and so on [1].

Nowadays almost major part of processing is using a high technology such as machine to operate the process. Machine thus not only can operate with high efficiency but it can run the process easily because it can be control and set up using the computer. Besides that, the country which involve in developing machine is more develop rather than other country. For an example Japan is one of the most the country which have high technical skill in develop the machine development and our country also use their machine in our industrial. Because of that, Japan has become one of the countries that provide machine to some of country in the world especially in South East Asia [1].

Until today, our country also use machine in almost all industry to make the work smooth and efficiently. As we know, machine can be operate more then human power so using a machine in processing is the most recognize. Beside that with machine

also work can be controlled using the computer thus make the system less to create to error and it is less then 10% of error happen.

Using a machine in Agriculture sector has help lots of the productivity of the product. According to the Malaysia eight and nine plan in agriculture sector, government have influence all the people involve to increase their production to develop the agriculture sector. In order to do that, machine is kinds of source which can help the farmer to increase their products because of we know machine can help with several process. So thus the product can be more such as double, triple or more than that [2].

1.1.1 Agricultural

Agriculture or farming is the simplification of nature's food webs and the rechanneling of energy for human planting and animal consumption. In other meaning agriculture is the production of food, feed, fiber, and other goods by the systematic growing and harvesting of plants, animal and other life forms. Agriculture encompasses many subjects including aquaculture, cultivation, animal husbandry and horticulture. In cultivation, both organic farming and intensive farming are include while in animal husbandry include s ranching and herding [3].

In agricultural there are two type of agriculture which can be specified on conventional agriculture and sustainable agriculture. Sustainable agriculture is determine as agro-ecology uses ecological principles to farm, hence the prefix agro to farm and ecology to the science of the relationship between organisms and their environment while the conventional agriculture involve altering or changing the natural environment.

The history of agriculture is a central element of human history as agriculture progress has been crucial factor in worldwide socio-economic change. The era of agriculture revolution began in the first two decades of 20th century. Agricultural production across the world doubled four times between 1820 and 1975 to feed a global

population of one billion human beings in 1800. During the same period, the number of people involved in farming dropped as the process became more automated [3].

Agriculture in Malaysia starts in era of 1980s during Eight Malaysia Plan Period. Export earnings of the sector increase significantly due to the increase in export volume and better prices of agricultural industrial commodities. Development economists in general, and agricultural economists in particular, have long focused on how agriculture can best contribute to overall economic growth and modernization, premised on their in-grained believe that robust agricultural growth and productivity increases are crucial to sustained economic development. Since then, and despite this widely acknowledged role of agriculture in economic development, many policy makers, policy analysts and academics in developing countries, international agencies and donor communities appear to have lost interest in the sector, often relegating its role ‘from engine of growth to sunset status’ (Siamwalla, 1996) arguing for its continuing relevance and importance because of its ‘multi-functionality role. However, after almost two decades of relative neglect, interest in agriculture is returning in a big and passionate way, as manifested in Malaysia where it is heralded as the next (third) engine of growth and promoted as ‘New Agriculture’ in Malaysia’s latest 5-year development plan known as the Ninth Malaysia Plan [4].

During the Ninth Plan period, the overall policy thrusts of the agriculture sector will focus on its reorientation towards greater commercialization and the creation of high-income farmers as well as promotion of greater private sector investment including foreign investment. In this regard, the policy thrusts will be as follows:

- increasing agricultural production including by venturing

During the plan period, efforts will be undertaken to increase agricultural production through new land development, replanting, land consolidation and rehabilitation. The private sector and the government-linked companies (GLCs) will be

further encouraged to increase agricultural investments through better incentives and support measures. In addition, research and development(R & D) on agronomic practices and product development as well as the commercialization of products from biomass and new products from biotechnology will be accelerated further. Measures will also be undertaken to further promote the nursery and landscape industry. Beside's that engineer have play and important role in agriculture development come out with new technology in order to improve the production of agriculture. New automation of handling machine is such as example where engineer make it to help the people in agriculture to increase their production.

Biotechnology is a new field in our country but then the percentage of the successful is increase drastically where people in this field have come out with formula and new gen after research to produce new agriculture sector such as products of paddy, plan, aquaculture and so on.

Financial institutions also give a big support when they will be encouraged to provide adequate funds for investments in agricultural production, processing, agro-based and other related agricultural activities as they know agriculture sector give profitable to them when more people involve in this sector. Measures will be undertaken by Bank Negara Malaysia (Central Bank) to ensure easier access to credit. Bank Pertanian Malaysia (Agricultural Bank) will be restructured to strengthen its capacity and capability in providing loans.

- into new sources of growth with greater private sector participation

Malaysia agricultural research and Development institute (MARDI) who is leader in agro-technology in our country have make many research about agricultural and it has been working and join venture with some private sector in some research and come out with new generation of plant which is more good to pretend from disease and can give twice or triple of the products.

Private sector such as Sime Darby and others which some are come from the outsiders contribute many of new in agricultural whether in their new technology or new source of growth which gives more profitable.

- diversification strengthening marketing and global networking

During the Plan period, focus will be given to improving the efficiency of marketing delivery services and strengthening the global network through strategic alliances. Towards this end, efforts will be undertaken to strengthen traditional markets and diversify into new markets. The marketing of agricultural industrial commodities, particularly palm oil will be focused on creating and strengthening niche markets by establishing a chain of production processes in strategic locations around specific regions and relocating manufacturing sub-processes to consuming countries as part of the efforts in market penetration.

Due to this new sector, government gives some special priority where sites for industrial are opened to new incomer from overseas for their investment. This will help our country in developing agriculture with their new technologies and make a global networking with them. When products are increase then the export field will much bigger so the global networking to all over the world will increase too.

- enhancing incomes of smallholders, farmers and fishermen

More effective measures will be undertaken to increase incomes of smallholders, farmers and fishermen through productivity improvements within the agricultural subsectors. Ageing smallholders and farers will be encouraged to participate in exit schemes through land consolidation and rehabilitation as well as group replanting programmed. Incomes of rubber and oil palm smallholders will be enhanced through replanting programmed using high yielding clones based on the mini-estate and group farming concepts as well as mixed farming including integration of livestock in plantations, aquaculture and off-farm economic activities.

In addition, sustainable income-generating activities will be promoted and training provided to improve the quality of life of subsistence farmers and the forest dependent communities.

- Improving the service delivery system

The restructuring of agricultural agencies will be undertaken to improve the delivery of services and facilitate the achievement of the growth target of the sector. Various agricultural activities will be managed and monitored on an integrated basis to eliminate duplication of functions and target groups as well as optimize utilization of resources. The integrated approach will also facilitate the development of value-added activities along the value chain including agro based processing [4].

To accelerate the development of kenaf and herbal industries, the Ministry of Agriculture (MOA) will be given the responsibility to oversee the development of these industries. Professionals from the private sector will be appointed on a pilot basis to manage agricultural projects in selected areas.

Besides that Federal Agricultural Marketing Authority (FAMA) is a marketing agency established by government under the Ministry of agricultural and Agro-based industry is responsible for various marketing activities. With this agency it will help small entrepreneur to bring up their products in the market. Thus service delivery system has been made by FAMA in order to clinch up the delivery system to the market.

- expanding agro-based processing activities and product

During the Plan period, agro-based development will focus on increasing utilization of agricultural produce in the production of high value-added products as well as processing activities. Efforts will be enhanced to increase private sector investment in agro-based processing activities including from agriculture related GLCs, subsidiary companies of the agricultural agencies as well as relevant associations and cooperatives.

Focus will also be given to increasing participation of individual farmers and fishermen in agro-based processing activities. The processing of end-products from agricultural industrial commodities is expected to increase further.

During the Plan period, the palm oil industry is expected to benefit from greater downstream product diversification. Commercialization of oil palm biomass products and biofuel will be expedited through greater private sector participation. Research on palm oil will focus on the utilization of advanced oleo chemical technology and biotechnology including nutraceutical and pharmaceutical products [4].

In line with the National Biotechnology Policy, the application of biotechnology to agriculture will be further promoted and intensified to harness the potentials of the agriculture sector in creating new wealth. To accelerate R&D activities in biotechnology, research institutions including institutions of higher education will be equipped with the requisite facilities and equipment. In addition, public researchers will be trained in the field of advanced biotechnology including biodiversity through attachment programmed and greater collaboration with the private sector [5].

1.1.2 Important of Agriculture

Since government has predicted sector of agricultural in Ninth Plan Period seriously, many people is taking part to involve in agriculture industry. Agriculture not jus give a profitable to people who are involve but then it will give profitable to our government in exportation and decrease the importation and indirectly open new jobs and vacancy for people who doesn't have any job [4].

The contribution of the agricultural sector not only provide incremental markets for new products manufactured in the industrial sector, it also has contribution on increasing the supply of food and new material to other sectors, tax revenue to the government to provide “investable surplus” to other expending sectors and to provide foreign exchange.

The first contribution of agricultural sector is to provide sufficient food for the labors in the industrial sector. According to this, the main important of the agriculture is to served and provide enough food to our citizens so that we can reduce amount of imports. We know that if supply of good to the modern sector cannot catch up with the demand of food in the modern sector, the modern sector has to spend a large amount of money to import food to feed the labors and have reduce the accumulation of capital. Without import government can reduce the tax of surcharge so that government can keep the money for other things. Beside price of local food and imported food has high different where local food is more cheaper compared to the imported food and normally local food is more fresh because it directly come from farm after harvesting. If in aquaculture sector, local fish is more expensive rather than imported fish because local fish normally is a fresh thing. If imported fish, it take week or more to reach in our country markets and the freshness of the fish is less compared to the local fish [4].

The second contribution of agriculture is to increase productivity of the agriculture. As we know, nowadays government has promoted new modern technology in both aquaculture and farms. With modern technology, almost all work starting from beginning till the end all process involve machine. Traditional method will less use because normally traditional methods take longer time than machine. With machine, work to be done just take faster than traditional method. Thus the product will give twice or triple or more than that using the modern technology. The modern technology has increase productivity of the agriculture [4].

1.1.3 Aquaculture Sector

Aquaculture is one of the agriculture part which is involved fish farming whether marine or fresh water fish. Aquaculture nowadays is one of the sectors which give a huge contribution in fisheries sector. Even though this sector actually support the fish market from fishermen product, but it is profitable because of the constants product it produce. The cost of the aquaculture quite costly due to its maintenance but then the product of aquaculture is profitable due to its quality.

In Malaysia fisheries is one of the main sources of the protein. According to the statistic have been made about 1, 160,288 tons of fish have been imported to our markets in 2003 and this no. have been increase drastically by year. In 2004 it shows 1, 537, 988 tons of the fish have been imported and about 32% has increase from year before. This showed even our country have provided the big no of fish whether from fishermen or aquaculture but it still not enough for our local markets. Based on this government has introduce its plan of agriculture in Malaysia 8 n 9 plans and under Third National agricultural policy (1998-2010) which is encourage more people to involve in agriculture and to archive target annually 1.93 million tones worth of fish RM 8.3 billion beginning 2010. The main target of the plans is to reduce import and increase export and the minor part is to give opportunity to those who doesn't have any work to get involve for their living salary [6].

1.1.4 Fresh Water Fish

In aquaculture, there are two types which are fresh water and saltwater fish species have been develop. In freshwater species there are catfish, patin, kelah, tilapia, baung, and so on which has been commercial in aquaculture. This fish have high value of demand and price because of its quality and it's also hard to catch. Thus government and Malaysia fisheries department has encourage people to make an aquaculture based on the fish which commercial.

Catfish is one of the most popular freshwater fish which is commercial not just in our country but in all over the world. Because of the high demand in markets, nowadays catfish have been rear in a big farmed to produce more fish for markets. According to the statistic which has been made by Federal agricultural Malaysia Authorities (FAMA), catfish in local markets also still not enough due to the daily food and industries. This is because catfish nowadays not just use as dish, but it also have been commercial to do sardine cans, keropok leko and so on. Thus our local catfish products also still can't fulfill the local markets [5].